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### Joint Section 3

Joint Section 3 refers to the copper tube that was soldered to the female brass compression fitting. Stereomicroscope photos of Joint Section 3 are shown in Figure 24 and Figure 25. The prominent features on Joint Section 3 are the large deposits of solder residue on the outer surface of the tube. Unlike Joint Section 1, the solder on the surface of this section of the copper tube appears to have been molten at some point after the joint was separated. This section of tubing was also cross-sectioned and metallographically prepared to analyze the interface between the copper tubing and the solder. An optical photomicrograph of this interface is shown in Figure 26. The thickness of the solder deposit on the copper tube is ~200  $\mu\text{m}$ , which is consistent with the thickness of the solder left on Joint Section 1.

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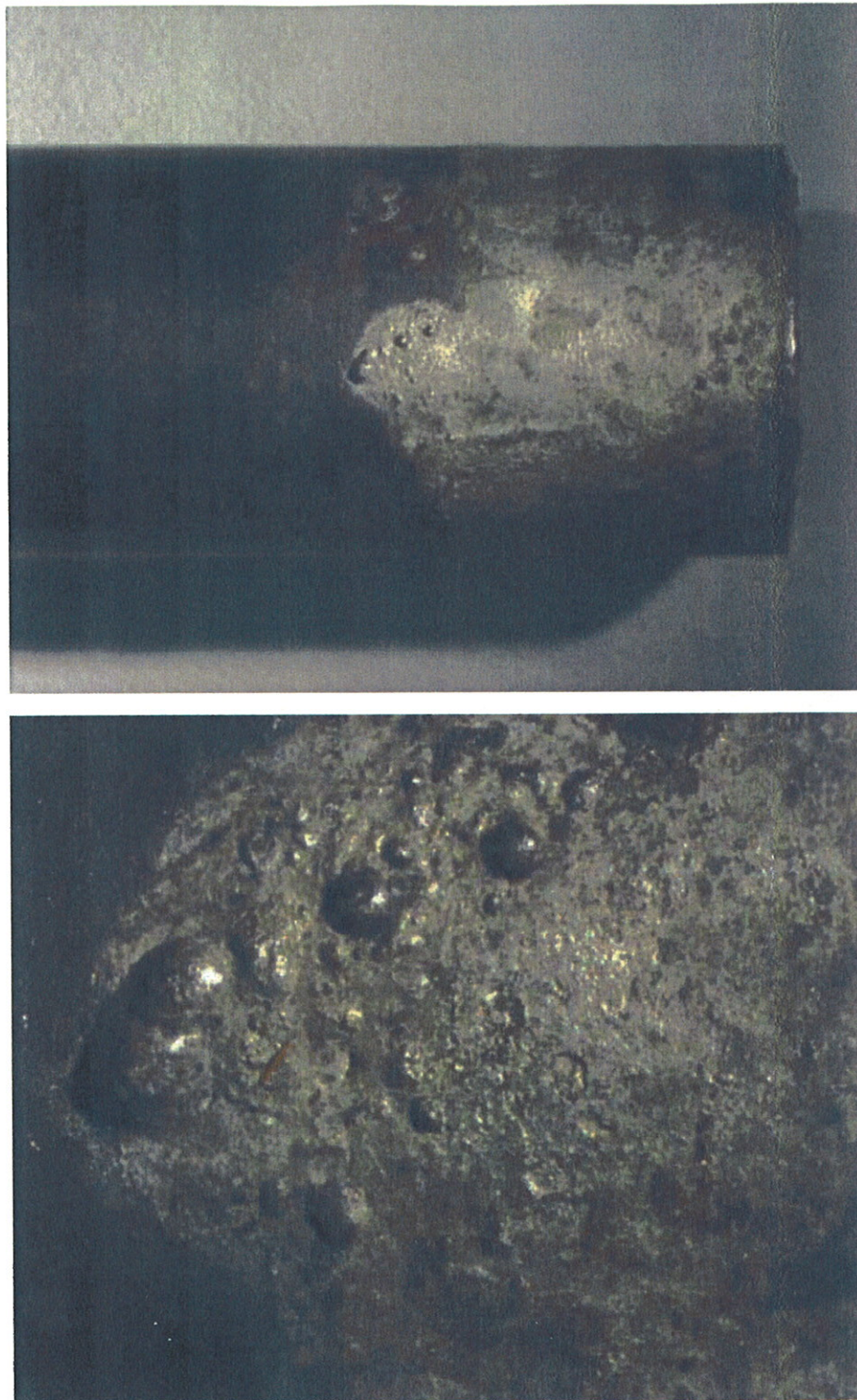


Figure 24. Stereomicroscope images of Joint Section 3 showing the solder remaining on the outer surface of the copper tube.



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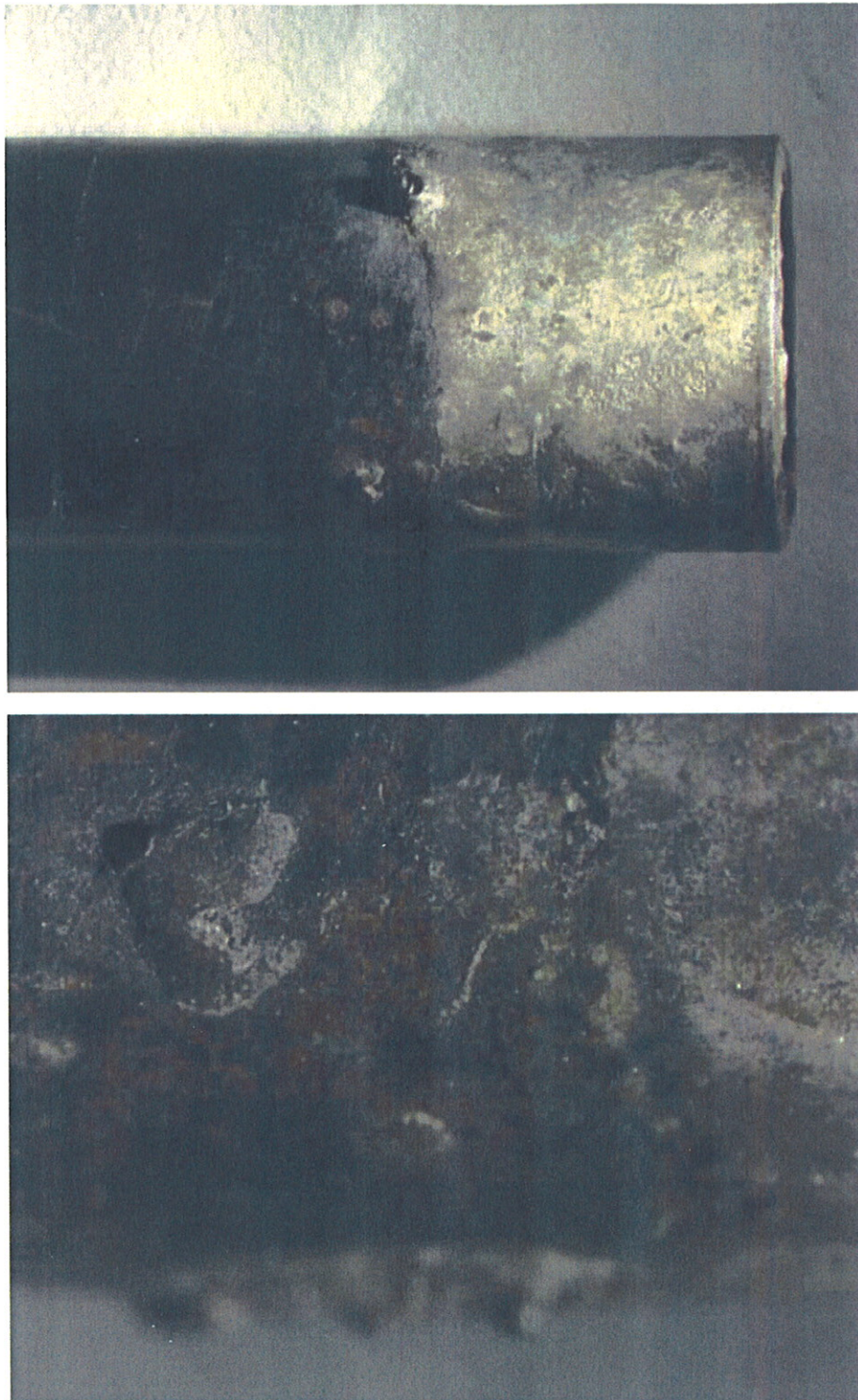


Figure 25. Stereomicroscope images of Joint Section 3 showing the solder remaining on the outer surface of the copper tube.

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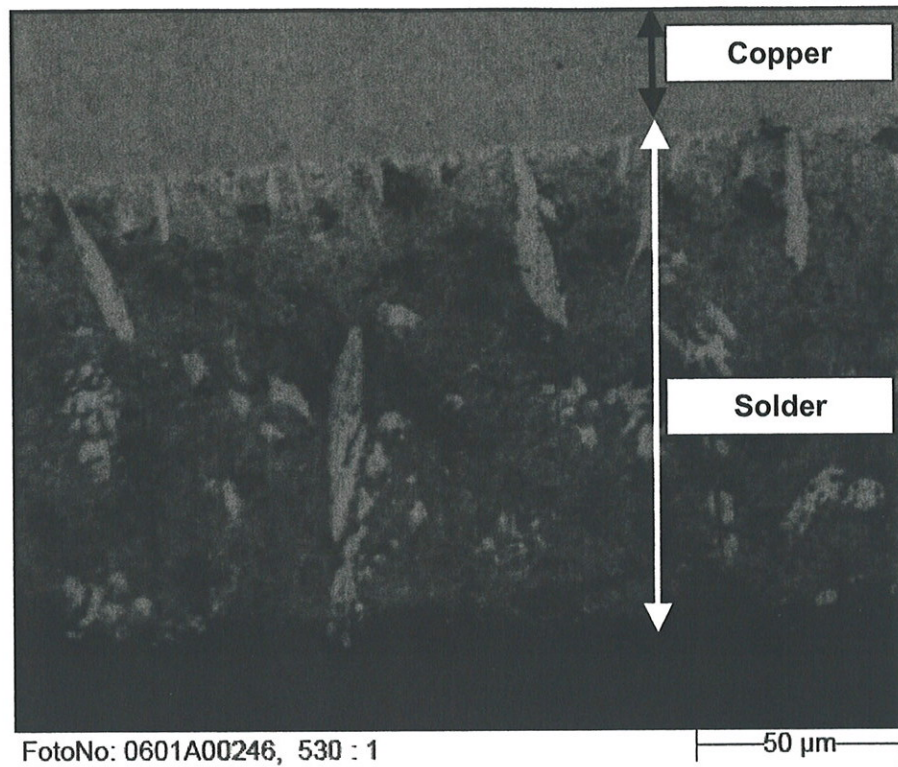


Figure 26. Optical photomicrograph of the cross-section of Joint Section 3 showing the amount of solder remaining on the copper tube.



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## Joint Section 4

Joint Section 4 refers to the female brass compression fitting that was soldered to the copper tube Joint Section 3. A stereomicroscope image of Joint Section 4 is shown in Figure 27. A backscattered SEM image of the inner surface of this fitting is shown in Figure 28. EDS analysis was performed in the regions outlined by red boxes #1 and #2. The spectra acquired from this analysis are shown in Figure 29 and Figure 30. As with the other brass fitting, the presence of tin on the surface is indicative of a surface film of solder, whereas the copper and lead are from the brass fitting. Figure 31 contains optical photomicrographs showing the polished cross-section of Joint Section 4. The thickness of the solder residue on the inner surface of the brass fitting is much less than that found on the copper fitting. This finding is similar to that for other brass fitting: Joint Section 2.



Figure 27. Stereomicroscope image of Joint Section 4.